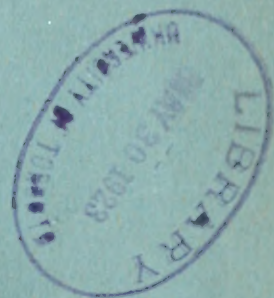


STORAGE
REPORT
OF
THE DIRECTOR
OF THE
ROYAL OBSERVATORY, HONGKONG,
FOR THE YEAR
1922



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REPORT OF THE DIRECTOR OF THE ROYAL OBSERVATORY, HONGKONG, FOR THE YEAR 1922.

I.—GROUNDS AND BUILDINGS.

The grounds were kept in order by the Botanical and Forestry Department with the assistance of the Observatory coolies.

Excavations for an underground room for the seismograph and clocks were commenced in September.

Gas fires in all rooms, and 2 geysers, were installed in November.

II.—METEOROLOGICAL INSTRUMENTS.

Barometers.—The Marvin compensated syphon barograph, which was set up in February, has worked well during the year, except that some mercury leaked at the ground joints.

The action of the barograph has been improved by the introduction of a buzzer, operated every minute for 0.7 second by a signal from the mean time clock.

The station barometer No. 1323 and the large Casella barometer are compared with the Observatory Standard usually once a month.

Beckley Anemograph.—This instrument was oiled and the orientation of the vane checked once a month.

Dines-Bacendell Anemograph.—The bearings of the vane were oiled and its orientation checked once a month. The spindle of the float was cleaned and oiled once a week. On March 26 a hole was drilled in the standard to permit of oiling the spindle above the mercury cup. The hole is closed by a screw to prevent the ingress of water or dust. The instrument requires frequent calibration. Its action at low velocities is uncertain.

The mean monthly results of comparisons with the records of the Beckley Anemograph from 1910-1921 are given in the following table, together with the results for 1922 :—

Factor for converting the actual run of the Beckley Anemograph cups to velocities recorded by the Dines Pressure Tube Anemograph.

Month.	Factor ($\text{Dines} \div \frac{\text{Beckley}}{3}$).	
	Mean 1910-1921.	1922.
January,	2'01	2'10
February,	2'05	2'22
March,	2'07	2'24
April,	2'09	2'42
May,	2'13	3'21
June,	2'17	1'32
July,	2'24	1'68
August,	2'20	1'24
September,	2'19	1'55
October,	2'12	1'44
November,	2'05	1'10
December,	2'01	1'16
Year,	2'11	1'81

Gap Rock Anemograph.—A leak developed in the float in the month of June. After several attempts to repair it the instrument was again brought to the Observatory. The alterations to the vane mentioned last year had the desired effect in increasing its sensibility, but with N and E winds, which are variable and gusty, it occasionally made a complete revolution and so carried the pen off the paper.

Thermometers.—All thermometers in use were compared with the Kew Standard in winter and summer.

Richard Thermograph.—This instrument worked satisfactorily during the year, though the base lines as laid down from the hourly eye observations of rotating thermometers still show irregularities, except on dull days with small range of temperature. This is due partly to thermograph lag.

III.—METEOROLOGICAL OBSERVATIONS AT THE OBSERVATORY.

Automatic records of the temperature of the air and evaporation were obtained with a Richard dry and wet bulb thermograph, and of the direction and velocity of the wind with a Beckley and a Dines-Baxendell anemograph, modified as described in the report for 1912. The amount of rain is recorded automatically by a Nakamura pluviograph, the amount of sunshine by two Campbell-Stokes universal sunshine recorders; and the relative humidity of the air by a small Richard hair hygograph. Eye observations of

barometric pressure, temperature of the air and of evaporation and the amount of cloud are made at each hour of Hongkong Standard time. The character and direction of the motion of the clouds are observed every three hours. Daily readings are taken of self-registering maximum and minimum thermometers.

Principal features of the Weather.—The principal features of the weather in 1922 were:—

- (a) Typhoon gales on July 12-13, July 27-29, August 3 and September 20-21.
- (b) Low barometric pressure in February, August and September.
- (c) Rainfall in serious defect from May 23 to July 6, and from September 23 to December 17. Heavy and well distributed rains from July 27 to September 4.
- (d) Low wind velocity in April and November.

Barometric pressure was considerably below normal in February, August and September. The mean pressure for the year at station lever was $29\cdot820^{\text{ins}}$, as against $29\cdot848^{\text{ins}}$ in 1921 and $29\cdot843^{\text{ins}}$ for the past 39 years. The highest pressure was $30\cdot445^{\text{ins}}$ on November 26 as against $30\cdot323^{\text{ins}}$ in 1921 and $30\cdot509^{\text{ins}}$ for the past 39 years. The lowest pressure was $29\cdot174^{\text{ins}}$ on August 3 as against $29\cdot319^{\text{ins}}$ in 1921 and $28\cdot735^{\text{ins}}$ for the past 39 years.

The temperature of the air was above normal from January to August, considerably in February and May and slightly in the other months. From September to the end of the year it was slightly below normal. The mean temperature for the year was $72^{\circ}\cdot4$ as against $72^{\circ}\cdot2$ in 1921 and $71^{\circ}\cdot8$ for the past 39 years. The highest temperature was $93^{\circ}\cdot1$ on August 2, as against $92^{\circ}\cdot2$ in 1921 and $97^{\circ}\cdot0$ for the past 30 years. The lowest temperature was $43^{\circ}\cdot7$ on November 26 as against $44^{\circ}\cdot0$ in 1921 and $32^{\circ}\cdot0$ for the past 39 years.

The rainfall was considerably above normal in February and August. It was considerably below normal from the middle of May to the beginning of July and from the end of September to the middle of December. The total for the year was $69\cdot43^{\text{ins}}$ as against $97\cdot34^{\text{ins}}$ in 1921, and $84\cdot23^{\text{ins}}$ for the past 39 years. The greatest fall in one civil day was $3\cdot70^{\text{ins}}$ on September 21 and the greatest in one hour was $1\cdot62^{\text{ins}}$ between 7.30 p.m. and 8.30 p.m. on August 28.

The wind velocity was considerably below normal in April and November, and moderately below in June, August, September and October. It was slightly above in January, February and July. The mean velocity for the year was 11.6 m.p.h. as against 10.7 m.p.h. in 1921, and 12.6 m.p.h. for the past 39 years. The

maximum velocity for one hour, as recorded by the Beckley Anemograph, was 5½ miles at 9 p.m. on September 20 as against 51 miles in 1921 and 108 miles for the past 39 years. The maximum squall velocity, as recorded by the Dines-Baxendell Anemograph, was at the rate of 75 m.p.h. at 11h. 5m. p.m. on September 20 as against 69 m.p.h. in 1921 and 105 m.p.h. for the part 13 years.

Rainfall at Four Stations.—In the following table the monthly rainfall for the year 1922 at the Observatory is compared with the fall at the Police Station, Tai Po; the Botanical Gardens; and the Matilda Hospital, Mount Kellet :—

Months.	Observatory (Kowloon).	Police Station (Tai-po).	Botanical Gardens (Hongkong).	Matilda Hospital (Hongkong).
	<i>inches.</i>	<i>inches.</i>	<i>inches.</i>	<i>inches.</i>
January,	2·66c	2·99	1·95	2·13
February, ...	5·490	7·68	5·49	4·72
March,	3·675	7·03	4·80	2·59
April,	2·020	2·17	2·34	2·22
May,	5·495	8·64	5·87	4·71
June,	6·525	16·46	7·20	6·49
July,	12·800	17·03	18·33	14·02
August,	17·535	19·50	20·15	15·83
September,...	9·935	9·88	8·51	6·56
October,	2·025	1·37	2·92	2·53
November, ...	0·535	0·38	0·64	0·75
December, ...	0·740	0·80	1·01	0·88
Year,...	69·435	93·93	79·21	63·43

Floods.—The heaviest rainfall occurred at the Observatory as follows :—

Period.				Amount.	Duration.	Greatest fall in 1 hour.	
d.	h.	d.	h.	inches.	hours.	Amount. inches.	Time. d. h.
June ...20	5 to	June 21	22	4·81	19	1·30	June 21 3
July.... 8	20 to	July 14	17	8·18	48	1·18	July 10 11
Aug....26	5 to	Sept. 4	19	10·88	72	1·62	Aug. 28 20
Sept....20	14 to	Sept. 22	14	5·65	40	0·80	Sept. 21 2

Typhoons.—The tracks of 20 typhoons and 11 of the principal depressions which occurred in the Far East in 1922 are given in two plates in the Monthly Meteorological Bulletin for December, 1922.

IV.—PUBLICATIONS.

Daily Weather Report and Map.—A weather map of the Far East for 6 a.m. of the 120th meridian, and the Daily Weather Report (containing meteorological observations, usually at 6^h. and 14^h., from about 40 stations in China, Indo-China, Japan, the Philippines and Borneo) and daily weather forecasts for Hongkong to Gap Rock, the Formosa Channel, the south coast of China between Hongkong and Lamocks, and between Hongkong and Hainan, were issued as in former years. Copies of the map were exhibited on notice boards at the Hongkong Ferry Pier, Blake Pier, and the Harbour Office. One copy was sent daily to the Institute of Engineers and Shipbuilders and one to the Director of the Meteorological Observatory, Macao. Forty copies of the Daily Weather Report were distributed to various offices, etc., in the Colony, and a copy was sent daily to the Director of the Meteorological Observatory, Macao. Copies were sent every week to the Hydrographic Office, Bangkok.

A charge of \$10 a year is made for supplying private firms and individuals with the Daily Weather Report, and \$36 for the Weather Map. No maps were published on January 1, February 12, March 4, July 7, 8, 9, August 3, 4, and 6, owing to the late arrival of weather telegrams. On several other occasions the map, though published, contained but meagre information.

The weather forecast is telegraphed daily to the Cape d'Aguilar Wireless Station in time for distribution at 1 p.m. It is broadcast again at 5 p.m.

Monthly Meteorological Bulletin.—The monthly Meteorological Bulletin, which includes the Daily Weather Report, was published as usual, and distributed to the principal observatories and scientific institutions in different parts of the world.

Monthly Seismological Bulletin.—The publication of a monthly seismological bulletin, giving particulars of earthquakes recorded by the Milne-Shaw seismograph, was continued throughout the year, and distributed to the principal seismological Observatories.

Miscellaneous Returns.—A monthly abstract of observations made at the Observatory is published in the Government Gazette, and monthly and yearly results are published in the Blue Book in the form suggested by the London Meteorological Office for the British Colonies. The monthly departures from normal of the barometric pressure at four China Coast Ports are communicated to the Commonwealth Meteorologist, Melbourne, in connection with long range weather forecasts. Monthly meteorological returns are forwarded to the Meteorological Magazine, and annual returns to the Stock Exchange Official Intelligence, the Colonial Office List, and Whitaker's Almanack.

V.—WEATHER TELEGRAMS, FORECASTS, AND STORM WARNINGS.

Daily Weather Telegrams.—The improvement in this service continues, but occasionally the observations from Japan and Indo-

China still arrive too late for insertion in the Daily Weather Map. Occasionally belated weather telegrams are received from South China, but as a rule the observations from these districts are posted in batches to Hongkong, as are those from Central China.

Extra Weather Telegrams.—The following stations send extra weather telegrams at half rate during typhoons, on receipt of certain code words from Hongkong:—Amoy, Canton, Macao, Phulien, Sharp Peak, and Taihoku. The Director of the Philippines Weather Bureau also sends extra telegrams, at his discretion, from Aparri or some other station nearer the typhoon centre. The extra 9 p.m. telegram from Swatow, kindly sanctioned by the Chinese Telegraph Administration during the typhoon season, was seldom received.

Weather Telegrams by Radio.—The following table gives the monthly number of ships, of different nationalities, from which radio meteorological messages have been received, and the number of messages received (each arrival and departure is counted separately).

Month.	<i>British (in- cluding H.M. Ships).</i>		<i>Dutch.</i>		<i>Japan- ese.</i>		<i>Other National- ities.</i>		<i>Total</i>	
	No. of ships	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.	No. of ships.	No. of messages.
January,	16	40	6	9	1	1	1	2	24	52
February,	14	40	4	6	2	5	...	...	20	51
March,	15	38	10	15	7	11	4	5	36	69
April,	13	31	8	10	1	4	1	2	23	47
May,	30	75	12	22	8	15	4	5	54	117
June,	31	78	15	28	8	18	10	20	64	144
July,	37	114	11	24	13	20	8	15	69	173
August,	27	56	16	35	19	29	7	10	69	130
September,	31	98	15	32	22	47	11	17	79	194
October,	29	61	15	25	29	58	5	10	78	154
November,	18	54	15	29	32	53	7	19	72	155
December,	19	47	13	28	22	44	7	29	61	148
Totals 1922,	280	...	140	...	164	...	65	...	649	...
Totals 1921,	121	...	84	...	40	...	21	...	266	...
Totals 1920,	64	...	48	...	25	...	3	...	140	...
Totals 1919,	17	...	36	...	6	...	2	...	61	...

It will be seen that the number of messages received has increased, averaging 1·8 ships per day in 1922. This represents only 12% of the average number of ships within call of Cape d'Aguilar, however. It is to be hoped that the time is not far distant when every ship within call will send observations by radio telegraphy as a matter of routine, in accordance with the Notice to Mariners on the subject.

Results of Weather Forecasts.—The results of the comparison of the daily weather forecasts with the weather subsequently experienced are given below, with the results of the previous five years :—

Year.	Complete Success.	Partial Success.	Partial Failure.	Total Failure.
	%	%	%	%
1917	67	29	4	0
1918	71	26	3	0
1919	71	27	2	0
1920	64	30	5	1
1921	65	30	5	0
1922	67	30	3	0

No forecasts were issued on January 1, February 12, March 4, July 7, 8, 9 and August 6, owing to lack of telegraphic information.

The forecast comprises wind direction, wind force, and weather.

Complete success means correct in three elements. Partial success means correct in only two elements. Partial failure means correct in only one element. Total failure means correct in no element.

The method of analysis is described in the 1918 Report.

Storm Warnings.—At the request of the Chamber of Commerce the Hongkong Government adopted the China Seas Storm Signal Code from 1920, June 1, in place of the Hongkong Non-Local Code introduced in 1917. The signals are displayed on Kowloon Signal Hill.

The following Ports are warned by a telegraphic adaptation of the code:—Sharp Peak, Swatow, Amoy, Santuao, Macao, Canton, Wuchow, Phulien, Taihoku, Manila, Labuan, and Singapore. 124 storm warnings were sent in 1922 and 141 were received from Manila. 26 were received from Phulien, *via* Quang Chau Wan Radio Station.

The storm warning service to Pakhoi and Hoilow has been discontinued, as the warnings never arrive in time to be of any use.

Local typhoon signals are exhibited on the Observatory radio mast and repeated at the Harbour Office, H.M.S. *Tamar*, Green Island, the Godown Company, (Kowloon), Lyemun, and Lai Chi Kok, during the day.

The local night signals are exhibited on the Observatory Radio Mast and repeated on the tower of the Kowloon Railway Station, on H.M.S. *Tamar*, and at the Harbour Office.

A translation of the non-local and local storm warnings is exhibited at the Harbour Office, the General Post Office and the Star Ferry Piers and also sent to the Cape d'Aguilar Radio station, whence it is broadcast at about noon and repeated every two hours until midnight. If a second warning is issued during the day, the later warning is substituted.

When a local storm warning is displayed at the Observatory a cone is exhibited at several outlying stations for the benefit of native craft and passing ocean vessels.

In the following table is given the number of hours the local signals were hoisted in each of the years 1918-1922.

Year.	Red Signals.	Black Signals.	Bombs. *
	Number of hours hoisted.		Number of times fired.
1918	33	102	1
1919	78	105	1
1920	107	156	...
1921	94	121	...
1922	181	154	...

The figures in the above table include the number of hours that night signals, corresponding to the day signals, were hoisted.

The red signals indicate that a depression exists which may possibly cause a gale at Hongkong within 24 hours. The black signals indicate that a gale is expected at Hongkong.

* Three bombs fired at intervals of 10 seconds indicate that wind of typhoon force is anticipated.

VI. — METEOROLOGICAL OBSERVATIONS FROM SHIPS.

TREATY PORTS, &c.

Logs received.—In addition to meteorological registers kept at about 40 stations in China, meteorological logs were received from 172 ships operating in the Far East. These logs, representing 5,763 days' observations, have been utilised for co-ordinating typhoon tracks. The corresponding figures for the year 1921 were 168 and 5662.

Comparison of Barometers.—The corrections to ships' barometers are usually obtained by comparing their readings while at Hongkong with those of the Observatory Standard. Occasionally ship captains bring their barometers to the Observatory to be compared with the Observatory Standard.

VII. — MAGNETIC OBSERVATIONS.

Horizontal force, declination, and dip are observed once a month. In the dip observations 4 needles are used in rotation, the result for each month being the mean of determinations with two needles.

In the following table are given the annual values of the magnetic elements in 1922, as derived from observations made in the new magnetic hut with magnetometer Elliott 83 and dip circle Doyer 71:—

	1922.
Declination (west)	0°21'57"
Dip (north)	30°43'47"
Horizontal Force (C. G. S. unit)	0.037279
Vertical Force (C. G. S. unit)	0.224194
Total Force (C. G. S. unit)	0.43286

During the eclipse of the Sun on September 21, observations of magnetic declination were made every minute by Colonel and Mrs. Roberts, Messrs. Claxton, Jeffries, Evans, Bodan Singh and Yuen Lai Sang. The observations were forwarded to Dr. Baker, Director of the Department of Terrestrial Magnetism of the Carnegie Institute, who is collecting information from all parts of the world for determining the effect of the eclipse on the earth's magnetism.

VIII. — TIME BALL.

Time Ball.—Prior to 1920, January 1, the Time Ball on Kowloon Signal Hill was dropped daily at 1 p.m. (120th Meridian Time). It is now dropped at 10 a.m. and 4 p.m. and daily, except on Saturdays when it is dropped at 10 a.m. and 1 p.m., and on Sundays and Holidays when it is dropped at 10 a.m. only.

The Ball is hoisted half mast at the 55th minute and full mast at the 57th minute. If the ball fails to drop at the correct time it is lowered at 5 minutes past the hour and the ordinary routine repeated at the following hour, if possible.

When the Time Ball is out of order the above routine is carried out with flag "Z", on the storm signal mast.

Time Signals are also given at night by means of three white lamps mounted vertically on the Observatory radio mast. From 8h. 56m. 0s. to 9h. 0m. 0s. p.m. the lamps are extinguished momentarily at the even seconds, except at the 2nd, 28th, 50th, 52nd, and 54th of each minute. The hours refer to Hongkong Standard Time (8 hours East of Greenwich).

The Time Ball was dropped successfully 653 times. There were 4 failures attributable to electrical defects, or negligence on the part of the computer on duty in the tower, who was dismissed. On 4 occasions the ball was not raised owing to the prevalence of high winds. The days on which the ball failed were April 1st and 25th, September 4th and 30th. These failures occurred at 10 a.m. and in each case the fault was remedied and the ball dropped at 11 a.m.

In the following table is given the number of times different errors occurred in the years 1921 and 1922:—

Error.	Number of Times.	
	1921	1922
0·3 sec. or less	573	633
0·4 "	34	10
0·5 "	11	6
0·6 "	12	2
0·7 "	6	...
0·8 "	4	1
0·9 "	2	1
1·0 "	4	...
1·1 "	2	...
1·3 "	2	...
1·5 "	2	...
1·6 "	2	...
1·8 "	2	...
2·0 "	1	...

The mean probable error of the time ball in each month for the past five years is given in the following table:—

Probable Error of the Time Ball.

Months.	1918	1919	1920	1921	1922
January,	± 0.11	± 0.14	± 0.17	± 0.23	± 0.31
February, .....	.13	.12	.13	.13	.13
March, .....	.15	.12	.13	.14	.12
April, .....	.12	.19	.15	.21	.12
May, .....	.12	.14	.17	.16	.11
June, .....	.14	.14	.13	.17	.11
July, .....	.11	.13	.22	.17	.14
August, .....	.26	.15	.11	.11	.11
September, .....	.16	.10	.24	.20	.15
October, .....	.12	.15	.15	.11	.11
November, .....	.12	.14	.19	.11	.17
December, .....	.14	.12	.13	.11	.11
Means,	± 0.14	± 0.13	± 0.18	± 0.18	± 0.15

Time Signals by Radio Telegraphy.—In addition to the time signals given by the Time Ball, and on the radio mast, signals are sent at 10h. and 21h. by radio telegraphy *via* Stonecutters. Particulars of the programme are given in the 1918 Report and in Government Notification No. 452 of 12.3.21. The service was transferred from Cape d'Aguilar to Stonecutters on May 1, 1921.

Radio Receiving Set.—The radio receiving set was in irregular use throughout the year. 109 comparisons were obtained with the Manila Observatory clock *via* Cavite, and 27 with the Tokio Observatory clock, *via* Funabashi.

The mean of the comparisons makes Tokio 0.54 sec. fast and Manila 1.03 secs. fast on Hongkong.

Between July 28th and August 26th Manila was not heard although listened for daily. This may have been due to defects in the receiving apparatus, the adjustments of which are extremely critical. From November 29th to December 26th no signals were heard, in spite of repeated attempts to adjust the apparatus. It was thoroughly overhauled and re-wired on December 22nd and 23rd since when it has worked satisfactorily.

The Siawei time signals (*via* Koukazu) were not heard, although listened for on many occasions.

Transit Instrument.—Observations for time were made daily with the 3-inch transit instrument and the Hipp tape chronograph by the Chinese computers, weather permitting.

The number of observations in the years 1921 and 1922 were as follows:—

	1921	1922
Transits	1,502	1,307
Level determination	800	696
Azimuth	56	31
Collimation	37	28

Transits of the Sun were utilized occasionally.

The azimuth and collimation determinations were made by the Chief and First Assistants from observations of the old south mark. The error so obtained was checked occasionally by observations of polar stars.

Clocks.—The performance of the Standard Sidereal clock conformed to no previous experience, and emphasises the necessity for a clock of more modern type, the rate of which may be depended upon during cloudy periods. During the past year cloudy periods (*i.e.* periods without transit observations) have, fortunately, not been prolonged.

In the following table is given the excess of the observed over the computed error after cloudy periods during 1922:—

Date 1922.		Interval without observations.	Excess of observed over computed error.
			<i>secs.</i>
January	4	2 days	— 0'09
"	13	2 "	+ 0'14
"	22	4 "	+ 0'14
February	2	8 "	— 0'40
"	15	4 "	+ 0'47
"	24	7 "	+ 0'06
March	9	12 "	+ 0'52
"	19	2 "	— 0'09
"	27	6 "	— 0'02
April	3	2 "	+ 0'45
"	7	3 "	+ 0'35
"	21	2 "	+ 0'32
"	27	3 "	— 0'12
May	16	4 "	+ 0'12
"	31	6 "	+ 0'11
June	7	2 "	+ 0'14
"	21	7 "	— 0'04
July	14	4 "	+ 0'50
"	30	3 "	+ 0'32
August	5	3 "	0'00
"	25	4 "	— 0'15
September	6	11 "	— 0'46
"	23	4 "	+ 0'12
October	5	3 "	+ 0'17
"	25	7 "	+ 0'06
November	7	2 "	+ 0'14
"	26	4 "	— 0'15
December	6	3 "	— 0'25
"	21	6 "	+ 0'03

The Dent Mean Time clock (No. 39740) was used throughout the year for dropping the Time Ball, maintaining the electric time service in the Observatory, and sending hourly signals to the Railway, the Post Office, the Telephone Co., and the Eastern Extension Telegraph Co. The clock is corrected daily before 10 a.m. and before 4 p.m. by the electric regulating apparatus. Its daily rate is kept below 0.5 sec. by the addition or removal of weights from the pendulum.

Chronometer Dent No. 10917 is on loan to the Cape d'Aguilar Radio Station. Dent No. 39946 was returned from the Peak Signal Station on December 9.

Batteries, Power Supply, &c.—The necessary current for the Time Service has been supplied by accumulator batteries, charged as found necessary from the alternating mains of the China Light & Power Co., Ltd. by a rotary converter.

IX. — MISCELLANEOUS.

Seismograph.—The east-west component of the Milne-Shaw seismograph has worked satisfactorily during the year, though there occur occasional dislocations of the register for which no reason can be assigned; also tremor storms and irregular movements, both large and small. The pendulum for recording N. S. movements was received in December.

Experiments made on April 20, 21, and 27 indicated that the temperature co-efficient of the seismograph, as regards tilt, is negligible.

144 earthquakes were recorded during the year. The seismograms have been forwarded to the President of the Seismological Committee, Oxford.

An underground room is being built for the reception of both pendulums and the standard clock.

Meteorological Observations at Victoria Peak.—These were so unsatisfactory that they were discontinued in December by order of His Excellency the Governor.

Atmospherics.—The intensity of atmospherics was recorded by the operators at Stonecutter's Radio Station, on a scale of 0 to 1, 13 times daily, 8 times on a long wave and 5 times on a short wave.

From March 12 to the end of the year the intensity and character of atmospherics were also observed by the operators at Cape d'Aguilar Radio Station hourly, on a scale of 0 to 6, the wave length being 600 metres. The maximum hourly intensity occurred at about mid-night in the summer and winter, and at

about 3 a.m. in the spring and autumn. The minimum intensity occurred at about 9 or 10 a.m. The maximum monthly intensity, 4.29, occurred in May with a shallow secondary maximum, 2.91, in August, and the minimum intensity, 1.71 in November.

The times are approximate and refer to Hongkong Standard Time (8 hours East of Greenwich).

Upper Air Research.—40 flights with pilot balloons were made during the year. The results of the observations have been sent to the *Commission Internationale pour l'exploration de la haute atmosphere*, Kristiania.

The Military Authorities very kindly placed at my disposal the services of two N.C.O.'s of the Corps of Royal Engineers to assist in this work, and two double theodolite ascents were made, the secondary station being the top of the time-ball tower. As the distance from the Observatory is only 2,055 feet, however, the results were not satisfactory above about 5,000 feet.

It is hoped that a more suitable secondary station may be found.

Up to the time of writing last year's report only two balloons had been found defective. During the past year however many such have been found. In future small monthly shipments will be ordered.

Wind Tables.—Tables for deriving the resultant direction and velocity of the wind from the north and east components were completed in the spring. They give direction from 0° to 360° to single degrees, and velocity, to tenths of a mile, for north and east components from +33 to -33 miles, by tenths of a mile from +3 to -3 miles and by single miles for the remainder. The object of the tables is to obtain the correct quadrant for the direction without mental effort on the part of the computer.

Effect of fan on wet bulb thermograph.—In the following table are given the revised corrections to the readings of an unaspirated wet bulb thermometer in an "Indian" shelter to reduce them to those of a whirled thermometer, at different wind velocities, and for different depressions of the wet bulb. The results are based on about 1,500 measures of the effect of an electric fan playing on to the wet bulb thermometer of the thermograph for the last 5 minutes of each hour. Only those hours have been used in which the register is sufficiently smooth to enable the effect of the fan to be measured with certainty.

The corrections are slightly larger than those given in the 1918 Report, indicating that aspiration for one minute is not sufficient. The wind velocity in the table is that recorded by the Beckley anemograph using the old factor 3. The cups of the anemograph are 45 feet above the ground.

Visitors.—Rear Admiral Learmouth, the Hydrographer, visited the Observatory on January 13. Lieut. A. L. B. Carmona, Harbour Master at Macao, came to obtain information concerning the Milne-Shaw Seismograph on September 25, and Professor K. Tamaguchi to obtain information concerning the Climate of Hongkong, on October 11. Sir Keith Smith visited the Observatory on October 10-12 in connection with a projected round the world flight. Professor Kiyogusa Sotome, of the Tokio Observatory, visited the Observatory on November 8, and the Rev. Father Algué S.J., director of the Philippine Weather Bureau, on December 21-22.

50 members of the Chinese Y.M.C.A. were shown over the Observatory on March 18. A class of 35 boys of the Diocesan School on March 28, and another class on March 29. 30 students of the Union Middle School, Canton, were shown over on October 30 and 15 students from St. Stephen's College, Hongkong, on December 7.

Staff.—No change occurred in the European staff. Mr. B. D. Evans, First Assistant, continued to act as Chief Assistant until the return of Mr. C. W. Jeffries on April 14.

The following re-grading of the local staff was approved on January 26 :—

2	3rd	Grade	telegraphist-computers
2	4th	..	.. ..
2	5th	..	.. ..

Probationers to receive \$60 a month until fit for promotion to 5th grade telegraphist-computers.

The new grading is to be adopted as opportunity offers.

Chu Ip Sheung was appointed probationer telegraphist on January 24. Yuen Lai Sang, who was transferred to the Post Office Department on 1921, December 31, was re-transferred to the Observatory as 4th grade telegraphist-computer on May 1, to replace Wan Sik Wing who had been on 3 months probation but had been found unsuitable.

Expenditure.—The annual expenditure on the Observatory for the past ten years is as follows :—

Year.	Total Expenditure.	Increase.	Decrease.
	\$ c.	\$ c.	\$ c.
1913	24,255.49	1,660.41	.....
1914	25,398.31	1,142.82	.....
1915	23,233.12	.....	2,165.19
1916	21,977.78	.....	1,255.34
1917	26,890.50	4,192.72	.....
1918	20,028.24	.....	6,862.26
1919	23,450.57	3,422.33
1920	25,965.66	2,515.09
1921	32,700.51	6,734.85
1922	38,350.10	5,649.59

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T. F. CLAXTON,
Director.

1923, February 9.

